CLAIMS:

1. Layer system for the protection against wear, for the protection against corrosion and for improving the sliding properties and the like, having an adhesive layer for the arrangement on a substrate, a transition layer for the arrangement on the adhesive layer and a cover layer of an adamantine carbon,

characterized in that the adhesive layer comprises at least one element from the Group which contains the elements of the 4th, 5th and 6th Subgroup and silicon, the transition layer comprises carbon and at least one element from the Group which contains the elements of the 4th, 5th and 6th Subgroup as well as silicon, and the cover layer comprises essentially adamantine carbon, the layer system having a hardness of at last 15 GPa, preferably at least 20 GPa, and an adhesion of at least 3 HF.

2. Layer system according to Claim 1,

characterized in that the transition layer is an individual or multipart gradient layer which changes in its composition continuously or in steps, and specifically with a carbon fraction which increases from the direction of the substrate and a fraction of at least one element of the Group containing the elements of the 4th, 5th and 6th Subgroup as well as silicon, which decreases from the direction of the substrate.

3. Layer system according to one of the preceding claims, characterized in that, in comparison to the adhesive layer and to the transition layer, the cover layer has a larger thickness.

4. Layer system according to one of the preceding claims, characterized in that the transition layer and/or the cover layer additionally comprises hydrogen and unavoidable impurities, the unavoidable impurities comprising noble gases, particularly argon and xenon.

5. Layer system according to Claim 4, characterized in that the cover layer contains only carbon or carbon and hydrogen.

6. Layer system according to Claim 4, characterized in that the cover layer has a hydrogen content of 5 to 30 atomic %, preferably 10 to 20 atomic %.

7. Layer system according to one of the preceding claims, characterized in that the at least one element from the Group comprising the elements of the 4th, 5th and 6th Subgroup is titanium and/or chromium.

8. Layer system according to one of the preceding claims, characterized in that the adhesive layer and the transition layer each has a thickness of from 0.05 μm to 1.5 μm, preferably of

from 0.1 μm to 0.8 μm.

9. Layer system according to one of the preceding claims, characterized in that the cover layer has a thickness of from 0.5 μm to 20 μm, preferably of from 1 μm to 10 μm.

10. Layer system according to one of the preceding claims, characterized in that the cover layer consisting of adamantine carbon has a fine-grained layer structure.

11. Process for producing a layer system, particularly according to one of Claims 1 to 10, on a substrate, characterized in that the process comprises

a) charging the substrate into a vacuum chamber and pumping down to a vacuum of a pressure of less than 10^{-4} mbar, preferably 10^{-5} mbar,

b) cleaning the substrate surface,

c) plasma-aided vapor-depositing of the adhesive layer on the substrate,

d) applying the transition layer to the adhesion layer by the simultaneous plasma-aided vapor depositing of the adhesion layer constituents and depositing carbon from the gas phase,

e) applying the adamantine carbon layer on the transition layer by a plasma-aided depositing of carbon from the gas phase, at least during process steps c), d) and e), a substrate bias voltage being applied to the substrate, and at least during

process steps d) and e), the plasma being stabilized by a magnetic field.

12. Process according to Claim 11, characterized in that the cleaning of the substrate surface comprises a heating step and/or an etching step.

13. Process according to Claim 12, characterized in that the heating step takes place by radiant heating, inductive heating and/or by electron bombardment.

14. Process according to Claim 13, characterized in that the electron bombardment is caused by the ignition of a low-voltage arc and the simultaneous application of a continuous AC or AC superimposed bias voltage, as particularly a pulsed positive substrate bias voltage.

15. Process according to Claim 10, characterized in that the etching step is carried out by ion etching, by means of a noble gas, preferably argon, and/or hydrogen as the process gas, a low-voltage arc being ignited and a continuous negative substrate bias voltage being applied to the substrate.

16. Process according to Claim 10, characterized in that the etching step is carried out by ion

etching by means of a noble gas, preferably argon and/or hydrogen as a process gas, an AC or AC superimposed bias voltage, particularly a pulsed, preferably medium-frequency substrate bias voltage, being applied.

17. Process according to one of Claims 10 to 16, characterized in that the vapor depositing of the adhesive layer takes place by PVD processes, plasma CVD processes, particularly arc vaporization, ion plating processes or cathodic sputtering.

18. Process according to Claim 17, characterized in that the vapor depositing of the adhesive layer is aided by an additional low-voltage arc discharge and a negative substrate bias voltage is applied to the substrate.

19. Process according to Claim 17, characterized in that the vapor depositing of the adhesive layer is aided by an additional pulsed substrate bias voltage, an AC or AC superimposed bias voltage, particularly a pulsed substrate bias voltage in a medium frequency range of from 1 to 10,000 kHz, preferably 20 to 250 kHz.

20. Process according to one of Claims 10 to 19, characterized in that, for the ignition of a plasma, a noble gas or a noble gas / hydrogen mixture, preferably an argon/hydrogen mixture is fed into the vacuum chamber.

21. Process according to one of Claims 10 to 20, characterized in that the transition layer is formed by an isochronous vapor depositing of at least one element from the Group which contains the elements from the 4th, 5th and 6th Subgroup and silicon, according to a process of one of Claims 17 to 20 and a plasma-aided depositing of carbon from the gas phase, additionally, a carbon-containing gas, preferably a hydrocarbon gas, particularly acetylene, being used as the reaction gas.

22. Process according Claim 21, characterized in that, as the thickness of the transition layer increases, the fraction of the carbon depositing is increased continuously or in steps.

23. Process according to one of Claims 10 to 22, characterized in that the adamantine carbon layer forming the cover layer is generated by the plasma CVD deposition of carbon from the gas phase, a carbon-containing gas, preferably a hydrocarbon gas, particularly acetylene, being used as the reaction gas.

24. Process according to one of Claims 21 or 23, characterized in that the reaction gas for depositing carbon, in addition to the carbon-containing gas, comprises hydrogen and/or noble gas, preferably argon and/or xenon.

25. Process according to Claim 24, characterized in that, during the depositing of the cover layer made of adamantine carbon, the fraction of the carbon-containing gas is increased and/or the fraction of the noble gas, particularly argon, is lowered.

26. Process according to one of Claims 21 to 25, characterized in that a unipolar or bipolar substrate bias voltage is applied to the substrate, which is pulsed in a medium frequency range of from 1 to 10,000 kHz, preferably 20 to 250 kHz.

27. Process according to Claim 26, characterized in that the substrate bias voltage is sinusoidal or is pulsed such that long negative and short positive pulse periods or large negative and low positive amplitudes are applied.

28. Process according to one of Claims 10 to 27, characterized in that, during the cleaning and/or the application of the adhesive layer and/or the transition layer and/or the cover layer made of an adamantine carbon, a longitudinal magnetic field with a uniform line of flux course is superimposed on the substrate, the magnetic field being variable continuously or in steps with respect to time and/or space.

29. Process according to one of Claims 10 to 28, characterized in that the application of the adhesive layer and/or the transition layer and/or the cover layer of adamantine carbon takes place at a pressure of from 10^{-4} mbar to 10^{-2} mbar.

30. Arrangement for coating one or several substrates, particularly for the implementation of the coating process according to one of Claims 10 to 29, having a vacuum chamber (1) with a pumping system (9) for generating a vacuum in the vacuum chamber (1), substrate holding devices (3) for receiving the substrates to be coated, at least one gas supply unit (8) for the metered addition of process gas, at least one vaporizer device (14) for providing coating material for the vapor depositing, an arc generating device (10, 13) for igniting a direct-voltage low-voltage arc, a device (16) for generating a substrate bias voltage, and having at least one or several magnetic field generating devices (17) for forming a magnetic far field.

31. Arrangement according to Claim 30, characterized in that the magnetic field generating device (17) is formed by at least one Helmholtz coil.

32. Arrangement according to Claim 31, characterized in that the Helmholtz coil can be controlled with respect to the producible magnetic flux density.

33. Arrangement according to one of Claims 30 to 32. characterized in that the arrangement for generating a substrate bias voltage is designed such that the substrate bias voltage can be varied continuously or in steps with respect to the preceding sign and/or the amount of the applied substrate bias voltage and/or can be operated in a bipolar or unipolar manner, preferably with a frequency in a medium frequency range.

34. Arrangement according to one of Claims 30 to 33, characterized in that the vaporizer device (14) comprises sputter targets, particularly magnetron sputter targets, arc sources, thermal vaporizers and the like.

35. Arrangement according to one of Claims 30 to 34, characterized in that the vaporizer device (14) can be separated from the remaining process chamber (1).

36. Arrangement according to one of Claims 30 to 35, characterized in that furthermore, the arrangement comprises a substrate heating system in the form of an inductive heater, a radiant heater or the like.

37. Arrangement according to one of Claims 30 to 36, characterized in that the arc generating deice (10, 13) comprises an ion source (10) and an anode (13) as well as a direct voltage supply (11), the ion source (10) being connected with the

negative pole of the direct voltage supply (11).

38. Arrangement according to Claim 37, characterized in that the positive pole of the direct voltage supply (11) can optionally be connected with the anode (13) or the substrate holding devices (3).

39. Arrangement according to one of Claims 37 or 38, characterized in that the ion source (10) comprises a filament, preferably a refractory filament, particularly made of tungsten, tantalum or the like, which is arranged in an ionization chamber which can be separated from the process chamber (1) by a screen, preferably a refractory screen, particularly made of tungsten, tantalum or the like.

40. Arrangement according to one of Claims 30 to 39, characterized in that the substrate holding devices (3) are movable, specifically preferably rotatable about at least one or several axes.

41. Arrangement according to one of Claims 30 to 40, characterized in that, in addition, permanent magnets (20) are provided for generating a magnetic near field.

42. Arrangement according to Claim 41, characterized in that the additional permanent magnets (20) are

constructed in a ring shape around the vacuum chamber (1), preferably with an alternating pole alignment, and are, in particular constructed as an magnetron electron trap.